June 29, 1995

Mr. William F. Caton
Secretary
Federal Communications Commission
1919 M Street, NW, Room 222
Washington, DC 20554

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Cellular
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Building The Wireless Future™

Re: *Ex Parte* Presentation
RM-8658

Dear Mr. Caton:

On Tuesday, June 27, 1995, the Cellular Telecommunications Industry Association ("CTIA") represented by Mr. Brian Fontes, Senior Vice President of Policy and Administration; Ms. Liz Maxfield, Senior Vice President of Industry Affairs; Mr. Randall Coleman, Vice President of Regulatory Policy and Law; and Ms. Andrea Williams, Staff Counsel, met with the following Commission staff to discuss issues concerning hearing aid compatibility with wireless technology.

Office of the Chairman

Ms. Ruth Milkman, Senior Legal Advisor

Office of Commissioner Rachelle B. Chong

Commissioner Rachelle B. Chong
Ms. Jill Luckett, Special Advisor to Commissioner Chong
Mr. Don Wong, Legal Intern

Office of Engineering and Technology

Mr. Bruce Franca, Deputy Chief
Mr. Steve Sharkey, Chief, Standards Development Branch
Mr. Robert Cleveland, Environmental Scientist
Mr. Michael Buas, Physical Scientist

At the meetings, CTIA presented the attached documents. Pursuant to Section 1.1206 of the Commission's Rules, an original and one copy of this letter and the attachments are being filed with your office. If you have any questions concerning this submission, please contact the undersigned.

Sincerely,

Andrea D. Williams
Staff Counsel

Attachments

HEARING AID COMPATIBILITY

- All digital technologies have the potential to interfere or interact with electronic devices. The degree and the nature of the interference or interaction will vary.

- Electromagnetic interaction ("EMI") between wireless telephones and hearing aids is an interference management issue, not a public health or access issue. To understand EMI between wireless telephones and hearing aids and to develop viable solutions, one must understand the auditory environment in which hearing aid users live.

- The industry has a comprehensive, responsible program underway to work in cooperation with hearing aid manufacturers and industry standards bodies to quantify the nature of the interference and develop solutions. This effort is being coordinated by the University of Oklahoma Center for the Study of Wireless Electromagnetic Compatibility.

The Hearing Aid Compatibility Act of 1988

The Hearing Aid Compatibility Act of 1988 ("HAC Act") requires the FCC to establish regulations to ensure ***reasonable access*** to telephone service by hearing impaired persons.

Electromagnetic interaction ("EMI") between wireless telephones and hearing aids is an interference management issue, not an access issue. Therefore, EMI is beyond the scope of the statute and the FCC's HAC regulations. The Food & Drug Administration and the FCC's Office of Engineering and Technology are the appropriate forums for addressing EMI issues.

Basic Requirements: Reasonable Access

To ensure reasonable access for hearing impaired persons, the HAC Act and the FCC's implementing regulations require certain telephones to be hearing aid compatible:

- Telephones manufactured in the United States (other than for export) after August 16, 1989; (cordless telephones - 8/16/91)
- Telephones imported for use in the United States after August 16, 1989;
- "Essential" telephones such as coin-operated telephones, "emergency use" telephones, and telephones frequently needed for use by persons using hearing aids, *i.e.*, closed circuit telephones which cannot directly access the public switched network.

A telephone is *hearing aid compatible* if it provides internal means for effective use with hearing aids that are designed to be compatible with telephones which meet established technical standards for hearing aid compatibility.

The HAC Act also mandates that the FCC must:

- Consider the costs and benefits to all telephone users, including persons with and without hearing impairments; and

- *Ensure that regulations adopted encourage the use of currently available technology and do not discourage or impair the development of improved technology.*

Exemptions for Mobile Services:

Congress and the FCC specifically exempted several categories of telephones from the HAC requirements, *i.e.*, cellular telephones, telephones used with other Part 22 common carrier services, and telephones used with private radio mobile services.

While the statute requires the FCC to review periodically the appropriateness of these exemptions,[1] the FCC cannot revoke or limit these exemptions without first making a determination that:

- Revocation or limitation of the exemption is in the public interest;
- Continuation of the exemption would have an adverse effect on hearing-impaired individuals;
- Compliance with the hearing-aid compatibility requirements is technologically feasible for the telephones to which the exemption applies; and
- Compliance with the hearing-aid compatibility requirements would not increase costs to such an extent that the telephones to which the exemption applies could not be successfully marketed.

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[1] The Commission has stated that it will review these exemptions at least every five years. *See Access to Telecommunications Equipment and Services by the Hearing Impaired and Other Disabled Persons*, 4 FCC Rcd 4596, 4600 (1989).

Waivers for "New Technology" Telephones:

The statute also provides the FCC with express authority to waive the HAC requirements for telephones associated with a new technology or service, *i.e.*, PCS.

To grant a waiver, the FCC must first determine, based upon the evidence in the record of the proceeding, that:

- The new technology or service is in the public interest; and

- Compliance with the HAC requirements is technologically infeasible, or would increase the costs of the telephones or the costs of the technology or services to the extent that such telephones, technology, or services could not be successfully marketed.

The FCC must also consider the effect of granting the waiver upon hearing-impaired individuals.

The FCC must periodically review and determine the need for the waiver.

Report on Hearing Aid Research

Recently there has been substantial interest in the area electromagnetic interference with hearing aids. This issue has been researched extensively in Europe and Australia. In June of this year, the National Acoustic Laboratories, a division of Australian hearing services, a Commonwealth Government Authority, presented a study titled: *Interference to Hearing Aids by the Digital Mobile Telephone System, Global System for Mobile Communications, GSM, (NAL Report No. 131, May, 1995),* to the Bioelectromagnetics Society in Boston. The study illustrates to the hearing aid community and the telecommunications industry the potential for solutions. The authors state:

> "In 1993 a digital mobile telephone system, Global System for Mobile Communications (GSM), was introduced in Australia and will completely replace the older analogue system by the year 2000. Concerns arose that the new system could cause interference to the operations of hearing aids or other electronic devices. This possibility was confirmed by measurements undertaken by Telecom Australia and Australian Hearing Services (AHS). This prompted an extensive investigation by AHS, Telecom, and AUSTEL (the telecommunications' industry regulator) in collaboration with Optus and Vodafone and other providers of *digital mobile telephone* services, the hearing aid industry and consumer representatives. This report presents the methodology and findings of the investigation and makes recommendations for minimising the interference problem.
>
> The primary aims of the study were: (a) to assess the degree of interference caused to a wide range of hearing aids by the operation of GSM *mobile telephone*; (b) to assess the effectiveness of various treatments and design modifications to hearing aids for reducing GSM interference. Important secondary aims were the development of criteria for hearing aid standards with respect to immunity from GSM interference.
>
> A highly effective measurement system was developed. It consists of a waveguide for generating radio-frequency fields and a manipulator for orienting the hearing aid to detect interference. Measurements were made on range of behind-the-ear and in-the-ear hearing aids which had varying degrees of susceptibility to GSM interference. This covered virtually the whole range of interference levels likely to occur in currently available hearing aids. Technical measurements were supplemented by subjective tests to determine the distance at which interference (a "buzzing" sound) could be detected by hearing-impaired people wearing appropriately fitted heating aids. The hearing aids were found to vary from some (high-immunity) models for which no interference was

detectable even with the hearing aid within a few centimeters from the telephone, to others (low-immunity) models for which interference was detectable at several metres or more. Interference was least for models with compact designs which minimsed the length of microphone leads.

Hearing aid treatments consisted of shielding, i.e. coating the hearing aid case with a conductive material or using metal-impregnated cases, and/or the inclusion of shunt capacitors in the circuit. The effect of the treatments varied from nothing to substantial. The tests show that it is possible and practical to design hearing aids to have high immunity although it may not always be practical to treat existing hearing aids to achieve high immunity. High immunity hearing aids would virtually ensure that the hearing aid wearer would not experience interference from other people's use of GSM *mobile telephones*. However, extremely high immunity is required to enable a hearing aid wearer to use a hand-held GMS telephone. Such immunity is achievable for some hearing aids.

This investigation has elucidated the potential interference problem, has demonstrated that it is possible to design high-immunity hearing aids, has developed a practical measurement system, and has provided data for making realistic recommendations about hearing aid immunity standards and the design and use of *mobile telephones* for minimising the problem of interference to hearing aids."

Excerpts from paper presented at GSM World Congress Madrid 7-9 February 1995

INTERFERENCE AND RADIATION RISKS ARE THEY A THREAT TO GROWTH

Stuart Sharrock
Editor, Mobile Communications International

The telecommunications industry has a proud track record of social responsibility. Monopolistic PTTs may not have excelled at customer service but they were perceived as benign organizations, employing large numbers of people, steeped in the tradition of universal service obligations.

The relatively new mobile communications sector has a rather different image. Operating in an intensely competitive environment, mobile operators are first and foremost business and customer oriented. Many people in telecommunications consider mobile operators to be the cowboys of the industry, working to a different set of values - and with social responsibility rather low on the list.

This is perhaps unfortunate. Overtly commercial organizations in high risk, high reward industries tend to be regarded with suspicion by the general public. Unlike the PTTs, the mobile sector is not generally perceived as having the interests of society to individual consumers at heart.

Such perceptions matter. There is an assumption that large, profitable industries are willing to cut corners. There is a belief that commercial pressures can result in products being released into the market place before they have been thoroughly tested; that big industries are prepared to exploit the public, ignoring potential health and environmental risks for the sake of commercial gain.

There are many examples that can be quoted, particularly from the pharmaceutical and chemical industries. Thalidomide, asbestos and DDT are perhaps the most well known. The whole of the nuclear energy industry could be regarded as a prime example.

The benefits of the products in question are undisputed. The problem is that they have side effects. And the increasing concern within society about health risks and environmental pollution means that very low level and infrequent side effects are often deemed to be unacceptable.

The fundamental difficulty with such issues is that they involve statistical processes and probabilities - an area that is not understood by people who have not had a scientific training and is certainly not understood by the majority of the legal profession. The concept of an

acceptable level of risk seems to an alien one to society which increasingly demands absolute guarantees of safety.

There is an extensive literature about the inability of lay people to understand probability statements. The conclusion is that people not trained in quantitative methods do not understand the issues of statistical independence the fundamental logic of probability. It is common, for example for people to believe that a one in four chance means that the event is bound to happen on the fourth trial. As judges and juries are no more capable of interpreting probability statements than they are of interpreting any other piece of highly technical information, there are insuperable barriers to their use in courts.
END PAGE 1.

PAGE 9
The investigations have focused on terminals rather than base stations. Base stations have greater output power but are sited in protected environments at a safe distance from people and electronic equipment.

The results showed that personal audio equipment and hearing aids were the most susceptible to interference from GSM and, of course, most likely to be in close proximity to GSM terminals. Hearing aids were considered to be the biggest potential problem and the investigation focused on this area.

In general, and rather simplistic, terms the average level at which various items of domestic equipment suffer detectable (but not necessarily annoying or disturbing) interference effects are as follows:

Cassettes decks	3 V/m
Hearing aids	4 V/m
Television receivers	4 V/m
Portable radios	6 V/m
Amplifiers	8 V/m
Telephones	8 V/m
Computers	8 V/m
CD players	14 V/m

In this context it should be noted that the CENELEC generic immunity standard specifies that domestic equipment must be immune to interference from RF electromagnetic fields of 3 V/m. It must also be appreciated that such average figures hide a wide range of variation amongst different models and designs. For hearing aids, for example, immunity levels range from less than 1 V/m to over 40 V/m.

The peak field strength from a GSM phone is approximately as follows:

Distance	1 m	2 m
Class 5 (0.8 W)	6 V/m	3 V/m
Class 4 (2W)	10 V/m	5 V/m
DCS 1800 (0.25W)	4 V/m	2 V/m

Clearly there is a potential problem. Not a safety problem but a problem that GSM may cause irritating and annoying interference to hearing aids users and domestic audio equipment. Hearing aid users are not unfamiliar with interference problems, interference caused by florescent lights is in fact generally worse than interference from GSM phones. But it was concluded that hearing aid users would be unable to use GSM phones - a conclusion that in practice has been found to be often incorrect.

To put these figures into context, note that field strengths of 5 V/m can be generated by interior electronic writing, a hair dryer produces around 50 V/m and an electronic razor 100 V/m. Overhead power line generate field strengths in the region of 100 V/m and electric fields during thunderstorms produces up to 20,000 V/m.

The solution suggested for the potential GSM interference problem was two-fold. It was proposed that the immunity of body-worn apparatus such as hearing aids should be increased to 10 V/m in
END PAGE 9

PAGE 10
the context of the European union's EMC Directive, originally scheduled to come into effect at the beginning of 1992 but now due for implementation in 1996. Tests showed that simple modifications to hearing aids such as spraying with conductive paint or addition of decoupling capacitors would easily enable them to meet the more stringent EMC criteria.

The second suggestion related to the implementation of GSM itself. Urban GSM systems should implement dynamic power control at the mobile station, limit cell sizes to reduce required transmit power, and implement discontinuous transmission where possible.

These suggestions have not been followed to any significant degree. In particular, the EMC Directive still appears to demand adherence to immunity standards which remain at 3 V/m in the domestic environment. The current status is that the CENELEC generic immunity standards require immunity against interference from GSM

in an industrial environment. But there is, as yet, no specific requirement imposed for the domestic environment although proposals for this are under consideration.

The hearing aid problems looks like it will stay with us for some time to come. Hearing aid manufactures are understandably reluctant to carry the financial burden of modifying and replacing their products whilst they are under no legal obligation to do so. In the meantime, the mobile communications industry is continually criticized for imposing addition burdens on an already disadvantages section of the community.

There are approximately five million users of hearing aids in Europe. Soon there will be the same number if GSM subscribers. Only about a quarter of hearing aid users have models which are susceptible to unacceptable levels of interference from GSM phones and this percentage is falling steadily with time as hearing aids are replaces.

Surely there is room for some cooperation effort between the hearing aid manufacturers and the GSM community to demonstrate the reality that the mobile communications industry is indeed socially responsible.

Stuart Sharrock
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The Honorable Reed E. Hundt
Chairman Federal Communications Commission
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Corporate R&D

26. March 1995

OML

Subject: Global System for Mobile communications (GSM) as an operating Standard for PCS in the United States of America.

Dear Mr. Chairman:

During the last few weeks, letters and reports regarding the public health and safety of GSM in the United States of America have been circulated between you, United States Senators, Senate Committees and Subcommittees, and Baker and Hostetler prompted in part by misinterpreted and unauthorized comments attributed to me in a report issued by Wireless Communications Council entitled: "The GSM Operating Standard for Personal Communications: A Threat to Hearing Aids and Other Consumer and Medical Electronic Devices". I am writing to you to clarify the situation on electromagnetic compatibility (EMC) between GSM, hearing aids, and other electronic and electrical equipment.

As director of Telelaboratoriet for Telecom Denmark, let me first of all clearly state that GSM telephones, hearing aids, and all other electronic and electrical equipment which meet the European Union EMC directive, 89/336/EEC, can operate simultaneously without interference from each other. This means that hearing aid users can successfully and comfortably use a 2 watt, handhold GSM telephone in conjunction with a hearing aided ear without interference. The only interference my laboratory has ever reported has been between old, inferior quality hearing aids located within three feet's or less of a handhold GSM telephone operating at it's maximum power level of 2 watts. In the existing population of hearing aids, one third had the immunity to be used with a GSM telephone, the rest had such good immunity that the probability for disturbances from other users of GSM telephones was found to be negligible.

In my little country of Denmark, over 250.000 people (4.8 % of the population) are currently using GSM telephones on two competitive, nation-wide networks and not one single complaint has been received by the Danish Telecom Inspector from

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hearing aid users, car owners, hospitals, airports, medical equipment suppliers, consumer protection agencies, etc.. I also wish to advice you that it is considered inaccurate for Wireless Communications Council to single out GSM as a potential interferer, as all analogue and digital radiotransmission standards can influence the function of electronic devices including, but not limited to AM, FM, AMPS, CDMA & D-AMPS. It must also be recognized that many digital radio transmitting systems, including D-AMPS, utilize the exact same radio access method as GSM, Time Division Multiple Access (TDMA).

As I have a background not only as a scientific telecommunications research expert, but also as a development manager for the hearing aid industry, I am consistently advising both industries in the development of new modulation technologies and EMC compatibility test methods. A complete copy of my research can be obtained upon request at facsimile number + 45 45 76 99 83.

With copy of letter to:
The Honorable Senator Trent Lott
The Honorable Senator Bob Packwood
Baker & Hostetler, Mr. Guy Vander Jagt

Sincerely,

Ole Mørk Lauridsen
Corporate Director R&D
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GSM TECHNOLOGY AND HEARING AIDS

Concerns have recently been raised regarding potential interference to hearing aids from a digital telecommunications technology based on the European GSM standard. Several providers of personal communications services (PCS) are planning to implement modified GSM technology in the United States. The competition among various potential providers of PCS equipment is fierce. It appears as though some of that competition may have stimulated the recent flap over GSM and hearing aids.

U.S. and European experts agree this is not a public health or safety issue, but rather an issue of interference management. In the United States and Canada, the joint health/safety committee of wireless carriers and manufacturers has advocated that interference management issues can best be addressed by cooperative inter-industry efforts to achieve electromagnetic compatibility (EMC). The North American wireless community is committed to support of industry and independent programs to address electromagnetic compatibility and interference management. In Europe, wireless carriers and manufacturers are engaged in inter-industry efforts to achieve EMC and the European Telecommunications Standards Institute (ETSI) is proposing additional shielding standards where appropriate.

The proliferation of new digital electronic equipment and radio frequency emitting equipment world wide means the potential for interference to or interaction with hearing aids is also increasing. World wide, the predominant source of reported interference to hearing aids has been from non-radio devices. In America, reported hearing interference is predominantly from non-radio electronic equipment, such as florescent lights and computers. Outside the United States, most digital systems use GSM modulation. The GSM MoU has 118 GSM radio operators in 69 countries serving over five million subscribers. Reported hearing aid interference has been limited, and typically associated with older, poorly shielded units. Interference studies by regulatory authorities, operators and the GSM MoU have demonstrated that cost effective hearing aid shielding ensures user access to digital phones and eliminates interference from other non-radio sources . ETSI studies of potential interference indicated personal audio equipment and hearing aids were most susceptible to interference from GSM. Similarly, early evaluations of digital radio in the U.S. and Canada indicate personal audio equipment and hearing aids are most susceptible to interference.

Efforts by industry and standards bodies are directed at promoting compatibility in the changing electromagnetic environment. Electromagnetic compatibility is the ability of a product or device to operate in its intended electromagnetic environment without receiving interference and without being a source of interference. An unshielded device, for instance, will sometimes malfunction or not perform optimally after picking up signals from other sources. In order to avoid this degradation in service, device

manufacturers provide a certain level of electromagnetic immunity (shielding) in their equipment. In Europe, the generic immunity standard specifies that domestic equipment must be immune to interference from RF electromagnetic fields of 3 volts per meter (3 V/m). In light of the rapid spread of digital equipment in Europe -- including phones that employ digital modulation -- ETSI is considering increasing the level of immunity from 3 V/m to 10 V/m. There are no generic immunity standards in the United States although much equipment meets the 3 V/m level.

The European Experience

Responding to concerns about interference to hearing aids, medical devices and other electronic equipment, European standards organizations have extensively studied the potential for interference. Results of the European testing indicated that personal audio equipment and hearing aids were most susceptible to interference from GSM. The average level at which hearing aids detected interference was about 4 V/m. Levels at which personal audio equipment -- including portable radios, amplifiers, CD players and television receivers -- detected interference ranged from 3 to 14 V/m. Hearing aids were considered to be the biggest potential problem and the European investigation focused on this area. The investigation concluded that although there was no public health or safety problem, there was the potential for GSM to cause interference to some hearing aid users.

This issue was the subject of a presentation to the recent GSM World Congress held in Madrid from February 7-9, 1995. In a paper presented to the Congress, Stuart Sharrock, Editor, *Mobile Communications International*, stated:

> "Clearly there is a potential problem. Not a safety problem but a problem that GSM may cause irritating and annoying interference to hearing aid users and domestic audio equipment. Hearing aid users are not unfamiliar with interference problems, interference caused by florescent lights is in fact generally worse than interference from GSM phones.... To put these figures into context, note that field strengths of 5 V/m can be generated by interior electronic wiring, a hair dryer produces around 50 V/m and an electronic razor 100 V/m. Overhead power lines generate field strengths in the region of 100 V/m and electric fields during thunderstorms produces up to 20,000 V/m"

As mentioned previously, the European solution was to propose increased immunity of body-worn devices to 10 V/m. The European Hearing Instruments Manufacturers Association is also investigating how to measure interference in an increasingly dynamic electromagnetic environment and how to design hearing aids that have sufficient immunity levels. Similar work is underway in Australia.

A factsheet issued in October 1994 by the Royal National Institute for Deaf People concludes:

> "Hearing aids do not last forever, and it is hoped that new hearing aids will be less affected by interference. Several organizations, including hearing aid manufacturers, are investigating the problem, and hearing aid manufacturers are working towards designing hearing aids that pick up less of the interference. That is why it is important to have a standard way of measuring the immunity of hearing aids. This standard is being developed as quickly as possible so it will be possible to compare hearing aids, and hearing aid purchasers will be able to buy hearing aids with high immunity."

Activities in the United States

In the U.S., most reported interference to electronic equipment has come from non-radio equipment. Reported radio interference to electronic equipment, including hearing aids, has typically come from private high power mobile radios such as those used by police, fire and emergency medical personnel, or from amateur radio. As digital technologies are incorporated into U.S. electronic and radio equipment, cooperation among manufacturers to provide EMC will be essential. The best path to electromagnetic compatibility is to understand the electromagnetic environment and to increase the immunity of devices to undesired transmissions.

Americans increasingly use cellular and paging devices for productivity and personal safety. Portable commercial radio is dramatically changing: wireless service providers including cellular, PCS, ESMR and paging operators are all offering or developing new digital services. These services will use more than one type of signaling modulation. Some cellular operators already provide digital service using TDMA modulation that is similar to GSM modulation. In the near future, wireless service providers will use CDMA and GSM modulation systems. GSM systems in the United States will differ from the GSM systems in Europe: U.S. systems will operate at higher frequencies and mobiles and portables will use lower power. Interference studies conducted in Europe are relevant for estimating interference in America. However, systems used in America will have less interference potential because of the lower power. Evaluations of interference from digital systems designed for the American market have shown that all can interfere with poorly shielded devices, including hearing aids, especially when the transmitter is adjacent to the hearing aid.

Wireless carriers and manufacturers in the United States and Canada have advocated that interference management issues can best be addressed by cooperative inter-industry efforts to achieve electromagnetic compatibility. This view is supported by the GAO study for Congress, and by testimony of the Health Industry Manufacturers Association and the FCC before Congress.

The wireless community has demonstrated its commitment to this approach through the support of industry and independent programs to address electromagnetic compatibility. It is the responsibility of all industries producing wireless and electronic devices work cooperatively to promote EMC. To this end, the Center for the Study of Wireless Electromagnetic Compatibility was established in 1994 at the University of Oklahoma with seed money from the wireless industry.

This independent Center assures that all businesses and industries have access to electromagnetic evaluation services. The Center has six functions: undertake testing to ensure that electronic devices are properly designed and installed to resist unintended interaction with external electromagnetic sources; host forums to address EMC issues; conduct research to evaluate and resolve EMC issues; educate consumers and users about EMC considerations; coordinate the activities of industries and organizations involved in setting EMC standards; and assist societies and trade organizations to address inter-industry EMC issues.

The wireless industry has requested that the Center undertake a hearing aid testing program with the involvement and cooperation of manufacturers of hearing aids for the North American market. It is hoped that such an effort will identify appropriate measures to eliminate interference, and provide information to help determine appropriate overall immunity levels for hearing aids, and user guides for hearing aid users.

Some misinformation has been developed based on interference studies in Europe. Electrical devices, including the different digital modulation radio systems, have the potential to interfere with other poorly shielded devices. In Europe, GSM systems operating at higher powers than those proposed for the United Stated are operated safely. Some hearing aid users have detected interference from GSM systems, and some hearing aid users in America will detect interference from digital wireless systems. The wireless industry is committed to electromagnetic compatibility, and will work cooperatively with hearing aid manufacturers to ensure all Americans can enjoy the benefits of a diverse, competitive wireless industry.

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Overview

GSM Phones & Hearing Aids

- "Please turn off all electronic devices ..." is a phrase that signals the dawn of the Digital Era. Breakthroughs in microchip technology, processor design and other areas have created a proliferation of new electronic products and services. Just as compact discs replaced vinyl records, digital circuitry is rapidly replacing the old analog technology.

- With analog wireless communications, a conversation travels through the air in the form of a continuous radio wave. And since all electronic circuits transmit and receive to some extent, manufacturers learned to prevent interaction with analog radio signals by properly shielding their devices.

- With digital transmissions, there is a different type of radio signal. A conversation is converted into the ones and zeros of computer code and transmitted as on-and-off pulses.

- Experience with analog has taught us how to solve any digital interference problems. Over the years we have been able to "harden" or shield electronics from analog transmissions. In fact, interference of the very first car radio to the spark plug assembly actually set the automobile on fire. The GSM digital interference can be solved through shielding.

- In a March 17, 1995, report to the House of Representatives Subcommittee on Government Management, Information and Technology, the GAO said, "According to officials from FDA's Center for Devices and Radiological Health, such "interference can best be prevented by using design and construction techniques that protect or shield medical devices from reasonably expected interference, specific standards are determined on a device-by-device basis."

- more -

- The cellular industry is attacking the problem on two fronts. First, we are informing consumers. Language will be included in phone instruction manuals. Second, we are identifying solutions. The Center for Electromagnetic Compatibility at the University of Oklahoma is currently conducting research in the hearing aid interference issue.

- In Europe, the generic immunity standard specifies that domestic equipment must be immune to interference from RF electromagnetic fields of 3 volts per meter (3 V/m). In light of the rapid spread of digital equipment in Europe -- including phones that employ digital modulation -- ETSI is considering increasing the level of immunity from 3 V/m to 10 V/m. There are no generic immunity standards in the United States although much equipment meets the 3 V/m level.

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Key Points

GSM Phones & Hearing Aids

- The proliferation of new digital electronic equipment and radio frequency emitting equipment world wide means the potential for interference to or interaction with hearing aids is also increasing.

- U.S. and European experts agree this is not a public health or safety issue, but rather an issue of interference management.

- In the United States and Canada, the joint health/safety committee of wireless carriers and manufacturers has advocated that interference management issues can best be addressed by cooperative inter-industry efforts to achieve electromagnetic compatibility (EMC).

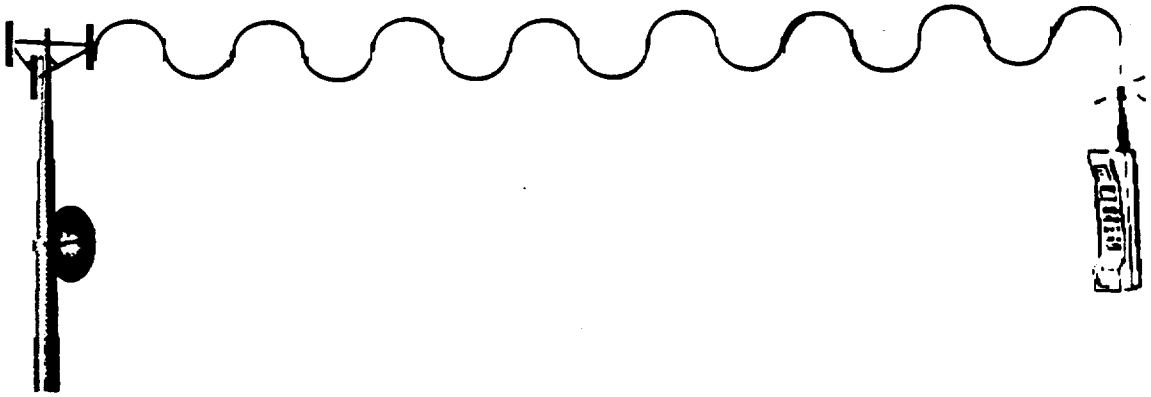
- The North American wireless community is committed to support of industry and independent programs to address electromagnetic compatibility and interference management. In Europe, wireless carriers and manufacturers are engaged in inter-industry efforts to achieve EMC and the European Telecommunications Standards Institute (ETSI) is proposing additional shielding standards where appropriate.

For Further Information Contact:
Mike Houghton, Director of Public Affairs & Communications, 202-785-0081

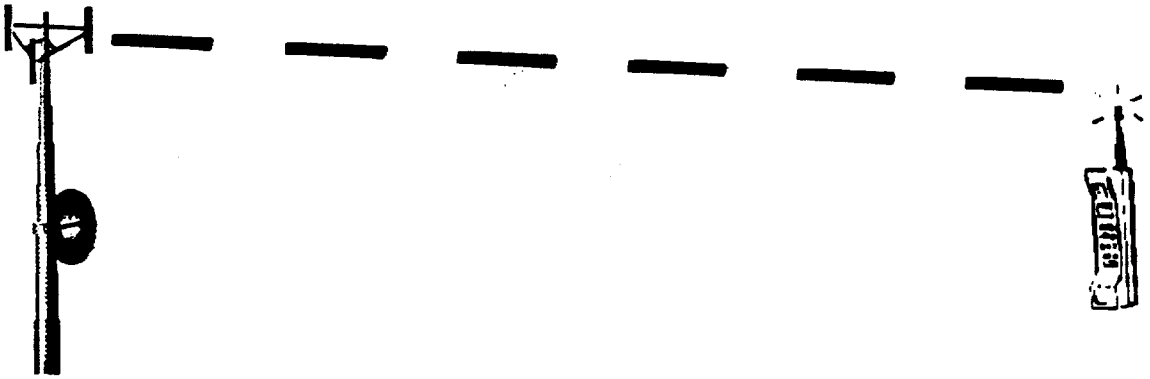
Digital Transmissions

GSM Phones & Hearing Aids

Cellular service today (analog) sends a voice through the air using continuous radio waves. As the voice signals travel through the air they get weaker with distance. Equipment in the cellular network returns the signal to its original strength, or amplifies it.



In digital transmissions, a conversation is converted into the ones and zeros of computer code. Unlike analog transmissions that are sent out as a continuously varying electrical signal in the shape of a wave, digital transmissions are a combination of on-and-off pulses of electricity.



Digital systems work differently. In the case of GSM (Global System for Mobile communications) the radio frequency is divided up into eight time slots of 0.5 milliseconds (ms) each, repeating every 5 ms. When using a GSM mobile telephone, every 5 ms of speech is digitally coded and sent out as a 0.5 ms burst of radio signal. These bursts, at a rate of 214 per second, can cause interference with hearing aids.

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The North American Experience

GSM Phones & Hearing Aids

- In the U.S., most reported interference to electronic equipment has come from non-radio equipment. Reported radio interference to electronic equipment, including hearing aids, has typically come from private high power mobile radios such as those used by police, fire and emergency medical personnel, or from amateur radio.

- As digital technologies are incorporated into U.S. electronic and radio equipment, cooperation among manufacturers to provide EMC will be essential. The best path to electromagnetic compatibility is to understand the electromagnetic environment and to increase the immunity of devices to undesired transmissions.

- Americans increasingly use cellular and paging devices for productivity and personal safety. Portable commercial radio is dramatically changing: wireless service providers including cellular, PCS, ESMR and paging operators are all offering or developing new digital services. These services will use more than one type of signaling modulation.

- Some cellular operators already provide digital service using TDMA modulation that is similar to GSM modulation. In the near future, wireless service providers will use CDMA and GSM modulation systems. GSM systems in the United States will differ from the GSM systems in Europe: U.S. systems will operate at higher frequencies and mobiles and portables will use lower power.

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Evaluations of interference from TDMA, GSM and CDMA systems designed for the American market have shown that all can interfere with poorly shielded devices, including hearing aids, especially when the transmitter is adjacent to the hearing aid.

- Wireless carriers and manufacturers in the United States and Canada have advocated that interference management issues can best be addressed by cooperative inter-industry efforts to achieve electromagnetic compatibility. This view is supported by the GAO study for Congress, and by testimony of the Health Industry Manufacturers Association and the FCC before Congress.

- The wireless community has demonstrated its commitment to this approach through the support of industry and independent programs to address electromagnetic compatibility. It is the responsibility of all industries producing wireless and electronic devices to work cooperatively to promote EMC. To this end, the Center for the Study of Wireless Electromagnetic Compatibility was established in 1994 at the University of Oklahoma with seed money from the wireless industry.

- This independent Center assures that all businesses and industries have access to electromagnetic evaluation services. The Center has six functions: undertake testing to ensure that electronic devices are properly designed and installed to resist unintended interaction with external electromagnetic sources; host forums to address EMC issues; conduct research to evaluate and resolve EMC issues; educate consumers and users about EMC considerations; coordinate the activities of industries and organizations involved in setting EMC standards; and assist societies and trade organizations to address inter-industry EMC issues.

- The wireless industry is currently working cooperatively with the pacemaker industry in funding a study by the Center of interaction between pacemakers and wireless portable devices. The wireless industry has also requested that the Center undertake a hearing aid testing program with the involvement and cooperation of manufacturers of hearing aids for the North American market. It is hoped that such an effort will identify appropriate measures to eliminate interference, and provide information to help determine appropriate overall immunity levels for hearing aids, and user guides for hearing aid users.

- Some misinformation has been developed based on interference studies in Europe. Electrical devices, including the different digital modulation radio systems, have the potential to interfere with other poorly shielded devices. In Europe, GSM systems operating at higher powers than those proposed for the United States are operated safely. Some hearing aid users have detected interference from GSM systems, and some hearing aid users in

America will detect interference from GSM, TDMA or CDMA systems. The wireless industry is committed to electromagnetic compatibility, and will work cooperatively with hearing aid manufacturers to ensure all Americans can enjoy the benefits of a diverse, competitive wireless industry.